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ACCESSIBLE LATITUDES FOR PLANETARY ENTRY PROBE MISSIONS TO SATURN, URANUS OR NEPTUNE

Abstract

In-situ probe measurements of planetary atmospheres add immense value to remote sensing observations from telescopes or orbiting spacecraft. Certain key measurements such as the determination of noble gas abundances and noble gas and other key isotope ratios can only be made in situ by atmospheric entry probes, but represent essential knowledge for investigating the formation history of the solar system as well as the formation and evolutionary processes of planetary atmospheres.

Within the scientific frame of atmospheric planetary sciences, a two- to three-year research study called IPED (Impact of the Probe Entry Zone on the Trajectory and Probe Design) investigates the impact of the interplanetary and approach trajectories on both the feasible range of atmospheric entry sites as well as the probe design, considering Saturn, Uranus and Neptune as target bodies.

This paper presents the results of a tool development that focuses on the approach circumstances of a planetary entry probe upon arrival depending on science objectives of the entry sites. Science objectives are organised in four (planetocentric) latitude ranges: (1) low latitudes $< 15°$, (2) mid latitudes between $15°$ and $45°$, (3) high latitudes between $45°$ and $75°$ and (4) polar latitudes of $> 75°$. The implementation and tool objective will be explained and discussed. The tool is based on a non-rotating, ellipsoidal body assuming a homogeneous gravitational field. The 3D visualization of accessible / non-accessible latitude regions depending on the parameters of the hyperbolic entry trajectory is discussed. The implementation includes the physical characteristics of the destination planet such as the planet's size, rotation period, shape and obliquity. Planets considered are Saturn, Uranus and Neptune.

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